do not conjugate until after infection. The nuclei of the zoosporangium divide during the growth stages by a process of amitosis like that figured by the writer in *Monochytrium*, but in the later reproductive stages they divide by mitosis, recalling conditions in *Synchytrium* and *Chrysophlyctis*. Fusion of the gametic nuclei in the zygote is delayed until the spring of the following year, the resting spores having of course matured in the meantime. Before they conjugate, however, they undergo a very peculiar process of budding by which large amounts of chromatin are extruded into the cytoplasm and central vacuole. The first division of the fusion nucleus appears to represent reduction, after which the nuclei are multiplied rapidly until the old resting spore becomes a zoosporangium very similar to the temporary sporangia.

The demonstration of such a primitive type of sexuality in *Olpidium* would seem to indicate clearly that it and its allies cannot be considered as having degenerated from higher fungi under "the debasing influence of parasitism." On the other hand, the facts so far brought to light do not give a clear indication of the source from which these forms may have come. It is evident, however, that they are polyenergid in contrast with *Synchytrium*, *Woroninella*, and *Chrysophlyctis*, which are essentially monoenergid, becoming coenocytic only during the reproductive period. KUSANO points out that this fact rules out the monoenergid Endosphaeraceae as indicative of the line of descent of *Olpidium*, though not necessarily eliminating the lower Protococcoideae in the region of *Chlamydomonas*. Now that cytological studies of the Archimycetes are beginning to accumulate, it is becoming increasingly evident that they represent not a single phylum, but a conglomeration of heterogeneous forms which have little in common except their apparent simplicity.—ROBERT F. GRIGGS.

Physiological effect of Bordeaux mixture.—Aside from its fungicidal value, Bordeaux mixture has been reported by several investigators to have a physiological action which results in an increased assimilatory activity of sprayed plants. This action has been further investigated by EWERT, who in a former paper reported experiments which indicate that, contrary to the generally accepted opinion, the physiological effect of Bordeaux mixture on the leaves of plants is detrimental. In the present paper EWERT[20] reports the results of an investigation of the effects of Bordeaux mixture on the assimilatory activity of the potato, radish, and bean; and on the sugar content of currants. The experiments with potatoes, radishes, and beans were conducted with plants grown in tanks under controlled conditions, and in soil kept at a constant water content. It was found that almost without exception the yield of tubers, roots, and pods, and of total dry matter was depressed by a covering of

[20] EWERT, R., Weitere Studien über die physiologische und fungicide Wirkung der Kupferbrühen bei krautigen Gewächsen und der Johannisbeere. Zeitschr. Pflanzenkrank. **22**:257–285. 1912.

Bordeaux mixture on the leaves. The depression of the yield increased with the strength of the mixture applied. As a rule, the beneficial effect of the mixture has been ascribed to the shade-effect of the covering, which was supposed to protect the plants from too great an intensity of light. EWERT found that bean plants shaded by a light gauze during periods of greatest illumination gave a greater yield and retained their leaves longer than unshaded plants. A similar effect produced by a covering of Bordeaux mixture, he thinks, would be counterbalanced by the ill effects of the shade on cloudy days and the toxic effects of the copper. In the experiments with currants, it was found that spraying berries with Bordeaux mixture or dipping them into it increased their sugar content considerably. How this effect is brought about is not yet clear. This effect on the berries is so striking that a decrease in their sugar content, due to depression of the assimilatory activity resulting from spraying the leaves, can be easily overlooked. Two sprayings of the leaves with 4 per cent mixture resulted only in a decrease of 0.5 per cent in the sugar content of the berries which were protected from the spray. This decrease is attributed to the deleterious effects of the mixture on the assimilatory activity of the leaves.—H. HASSELBRING.

Dispersal of seeds by ants.—SERNANDER[21] organized the disjointed and inaccurate data on the importance of ants in the distribution of certain seeds and fruits, and added a wealth of observations and experimental evidence upon this phase of ecological science. This particular kind of distribution he termed "myrmecochorous," and showed that it was almost wholly due, not to the supposed mimicry of the pupa of ants by the seeds, but to the presence of certain oil bodies or "elaiosomes" which serve as food for the ants and hence cause their collection and storage. These bodies occur as various morphological modifications or appendages of seeds and fruits, various types being distinguished. Some 120 plants were at that time listed as myrmecochorous, and evidence was produced that the activity by a single colony of ants for one season includes the transportation of many thousand seeds, some to distances of 15 to 70 meters.

A recent article by MORTON[22] calls attention to the important foundation laid by SERNANDER, cites the contributions that have appeared since that date, and summarizes the present situation of myrmecochory. The number of myrmecochorous plants has been considerably increased, although these studies have been almost exclusively confined to Europe. The associations affected are mostly those of woodland and ruderal plants. MORTON concludes that ants have been acting as a selection factor for such plants at least since

[21] SERNANDER, R., Entwurf einer Monographie der europäischen Myrmekochoren. Kungl. Vetensk. Akad. Upsala **41**: 1906.

[22] MORTON, FRIEDRICH, Die Bedeutung der Ameisen für die Verbreitung der Pflanzensamen. Mitt. Naturwiss. Vereins 1912:77–112. Reprint by author, 1913.